

# SAMPLE PAPER - MATHEMATICS (MSEP-13)

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**Time Allowed: 3 Hours**

**Maximum Marks: 100**

## General Instructions:

1. This question paper contains 35 questions. All questions are compulsory.
  2. Question 1 to 18 are Multiple Choice Questions (MCQs) carrying 1 mark each.
  3. Questions 19 and 20 are Assertion-Reason based questions carrying 1 mark each.
  4. Section B (Questions 21 to 25) contains Very Short Answer Type questions carrying 2 marks each.
  5. Section C (Questions 26 to 30) contains Short Answer Type questions carrying 4 marks each.
  6. Section D (Questions 31 to 35) contains Long Answer Type questions carrying 6 marks each.
  7. Internal choices are provided in some questions.
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## SECTION A

### (Multiple Choice Questions)

1. If  $|x - 1| > 5$ , then
  - (a)  $x \in (-4, 6)$
  - (b)  $x \in [-4, 6]$
  - (c)  $x \in (-\infty, -4) \cup (6, \infty)$
  - (d)  $x \in (-\infty, -4) \cup [6, \infty)$
2. The number of words which can be formed out of the letters of the word 'ARTICLE', so that vowels occupy the even place is
  - (a) 1440
  - (b) 144
  - (c) 7!
  - (d)  ${}^4C_4 \times {}^3C_3$

3. The ratio in which the line  $3x + 4y + 2 = 0$  divides the distance between the lines  $3x + 4y + 5 = 0$  and  $3x + 4y - 5 = 0$  is
- 1:2
  - 3:7
  - 2:3
  - 2:5
4. If the focus of a parabola is  $(0, -3)$  and its directrix is  $y = 3$ , then its equation is
- $x^2 = -12y$
  - $x^2 = 12y$
  - $y^2 = -12x$
  - $y^2 = 12x$
5. Mean deviation for  $n$  observations  $x_1, x_2, \dots, x_n$  from their mean  $\bar{x}$  is given by
- $\sum_{i=1}^n (x_i - \bar{x})$
  - $\frac{1}{n} \sum_{i=1}^n |x_i - \bar{x}|$
  - $\sum_{i=1}^n (x_i - \bar{x})^2$
  - $\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$
6. If  $M$  and  $N$  are any two events, the probability that atleast one of them occurs is
- $P(M) + P(N) - 2P(M \cap N)$
  - $P(M) + P(N) - P(M \cap N)$
  - $P(M) + P(N) + P(M \cap N)$
  - $P(M) + P(N) + 2P(M \cap N)$
7. The centre and radius of the circle  $x^2 + y^2 + 8x + 10y - 8 = 0$  are:
- Centre  $(-4, -5)$ , radius 7
  - Centre  $(4, 5)$ , radius 7
  - Centre  $(-4, -5)$ , radius 49
  - Centre  $(4, 5)$ , radius 49
8. A point  $R(h, k)$  divides the line segment between the axes in the ratio 1:2. The equation of the line is:
- $2kx + hy = 3hk$
  - $kx + 2hy = 3hk$
  - $2hx + ky = 3hk$
  - $hx + 2ky = 3hk$
9. The equations of the lines through  $(3, 2)$  making  $45^\circ$  with  $x - 2y = 3$  are:
- $3x - y - 7 = 0$  and  $x + 3y - 9 = 0$

- (b)  $3x + y - 11 = 0$  and  $x - 3y + 3 = 0$
- (c)  $2x - y - 4 = 0$  and  $x + 2y - 7 = 0$
- (d)  $2x + y - 8 = 0$  and  $x - 2y + 1 = 0$

10. The derivative of  $\frac{\sin(x+a)}{\cos x}$  is

- A)  $\frac{\cos a}{\cos^2 x}$
- B)  $\frac{\cos(x+a)}{\cos x} - \frac{\sin(x+a) \sin x}{\cos^2 x}$
- C)  $\cos a \cdot \sec^2 x$
- D) All of the above are equivalent

11. Three vertices of a parallelogram ABCD are A(3, -1, 2), B(1, 2, -4), C(-1, 1, 2). The fourth vertex D is:

- (a) (1, -2, 8)
- (b) (1, 2, 8)
- (c) (-1, -2, 8)
- (d) (1, -2, -8)

12. For the circle  $x^2 + y^2 + 8x + 10y - 8 = 0$ , the centre and radius are:

- A) Centre (4, 5), radius 7
- B) Centre (-4, -5), radius 7
- C) Centre (-4, -5), radius 49
- D) Centre (4, 5), radius 49

13. The slope of the line passing through the origin and the midpoint of the segment joining P(0, -4) and Q(8, 0) is:

- (a)  $\frac{1}{2}$
- (b)  $-\frac{1}{2}$
- (c) 2
- (d) -2

14. The sum of the series  $i + i^2 + i^3 + \dots$  up to 1000 terms is:

- (a) 0
- (b) 1

- (c) i
- (d) -1

15. If  $\tan A = \frac{1}{2}$  and  $\tan B = \frac{1}{3}$ , then  $\tan (2A + B)$  is equal to

- (a) 1
- (b) 2
- (c) 3
- (d) 4

16. The domain and range of the real function  $f(x) = \sqrt{x-1}$  is

- (a) Domain =  $(1, \infty)$ , Range =  $(0, \infty)$
- (b) Domain =  $[1, \infty)$ , Range =  $(0, \infty)$
- (c) Domain =  $(1, \infty)$ , Range =  $[0, \infty)$
- (d) Domain =  $[1, \infty)$ , Range =  $[0, \infty)$

17. Two finite sets have  $m$  and  $n$  elements. The number of subsets of the first set is 112 more than that of the second set. The values of  $m$  and  $n$  are, respectively

- (a) 4, 7
- (b) 7, 4
- (c) 4, 4
- (d) 7, 7

18. If the relation  $R$  be defined on the set  $A = \{1,2,3,4,5\}$  by  $R = \{(a, b) : |a^2 - b^2| < 8\}$ . Then,  $R$  is given by .....

- (a)  $\{(1,1), (1,2), (2,1), (2,2), (2,3), (3,2), (3,3), (4,4), (4,5), (5,4), (5,5)\}$
- (b)  $\{(1,1), (1,2), (2,1), (2,2), (3,3), (4,4), (5,5)\}$
- (c)  $\{(1,1), (2,2), (3,3), (4,4), (5,5)\}$
- (d)  $\{(1,2), (2,3), (3,4), (4,5)\}$

### (Assertion-Reason Type Questions)

19

**Assertion (A):** If  $(x - 2, y + 5) = (-2, \frac{1}{3})$  are two equal ordered pairs, then  $x = 4, y = -\frac{14}{3}$ .

**Reason (R):** Two ordered pairs are equal if and only if their corresponding first elements are equal and their second elements are also equal.

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

**Assertion (A):** The sum of probabilities of two students getting distinction in their final examinations is 1.2.

**Reason (R):** Probability of any event lies between 0 and 1, so the sum of two probabilities cannot exceed 2.

- (a) Both A and R are true and R is the correct explanation of A.  
 (b) Both A and R are true but R is not the correct explanation of A.  
 (c) A is true but R is false.  
 (d) A is false but R is true.

## SECTION B

### (Very Short Answer Type Questions)

21. How many 6-digit numbers can be formed from the digits 0, 1, 3, 5, 7 and 9 which are divisible by 10 and no digit is repeated?
22. Evaluate the following limit:  $\lim_{x \rightarrow 0} \frac{\cos x}{\pi - x}$ .
23. Find the equation of the set of points P, the sum of whose distances from A(4, 0, 0) and B(-4, 0, 0) is equal to 10.
24. Events E and F are such that  $P(\text{not } E \text{ or not } F) = 0.25$ . State whether E and F are mutually exclusive.
25. Find the equations of the hyperbola with foci  $(0, \pm\sqrt{10})$ , passing through (2,3).

OR

Solve for  $x$ :  $-5 \leq \frac{2-3x}{4} \leq 9$ .

## SECTION C

### (Short Answer Type Questions)

26. Find the value of  $(a^2 + \sqrt{a^2 - 1})^4 + (a^2 - \sqrt{a^2 - 1})^4$ .
27. The sum of first three terms of a G.P. is  $\frac{13}{12}$  and their product is -1. Find the common ratio and the terms.

OR

The sum of first three terms of a G.P. is  $\frac{39}{10}$  and their product is 1. Find the common ratio and the terms.

28. Using the Binomial Theorem, prove that  $6^n - 5n - 1$  is always divisible by 25, where  $n \in \mathbb{N}$ .

29. If the function  $f(x)$  satisfies  $\lim_{x \rightarrow 1} \frac{f(x)-2}{x^2-1} = \pi$ , evaluate  $\lim_{x \rightarrow 1} f(x)$ .

30. Find the equation of a circle with centre (2, 2) and passes through the point (4, 5).

31. Compute the derivative of  $g(x) = \cot x$ .

**OR**

The sum of four numbers in G.P. is 60 and the arithmetic mean of the first and last is 18. Find the numbers.

### **SECTION D**

#### **(Long Answer Type Questions)**

32. The mean and standard deviation of a group of 100 observations were found to be 20 and 3, respectively. Later on it was found that three observations were incorrect, which were recorded as 21, 21 and 18. Find the mean and standard deviation if the incorrect observations are omitted.

33. Find the equation for the ellipse that satisfies the given conditions: Foci at  $(\pm 5, 0)$ , length of major axis is 12.

34. Find the sum of the following series up to  $n$  terms:  $.6 + .66 + .666 + \dots$ .

**OR**

Find the coordinates of the foci and the vertices, the eccentricity and the length of the latus rectum of the hyperbola  $49y^2 - 16x^2 = 784$ .

35. Find the coordinates of the focus, axis of the parabola, the equation of the directrix and the length of the latus rectum for the parabola  $x^2 = -9y$ .